DIGITAL OR VIRTUAL UNIVERSITIES?
PROJECT “DIGITAL LECTURE HALL”

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SUMMARY: Part I of this project report questions the feasibility of the many “virtual university” projects worldwide which attempt a rather drastic switch from real to virtual set-ups. In contrast, the author sketches a path from real to virtual campuses which takes much longer to go but i) is shown to be more feasible and ii) includes intermediate milestones which represent valuable educational set-ups in their own right. Part II gives an overview about the Digital Lecture Hall (DLH) project, describing a venue in which the milestones as sketched in part I can be realized. The project builds on experience from digital classrooms built by the author’s and other research teams in the past, but is the first to fully integrate such technology and to extent it from some 20 or 30 to 150 and more local participants. The full presentation will provide more details about the DLH project.

PART I. The long way to virtual universities and its exciting milestones

Continuous and tertiary education worldwide are currently faced with a race towards corporate and virtual universities. Politicians and managers seem to be delighted with the budget-relieving vision of virtual teachers that can be replicated by way of keystrokes. However, a closer look reveals two basic problems:

• Firstly, the development efforts for suitable course material are tremendous in a virtual university set-up
• Secondly and even more important, very little teaching experience exists in virtual set-ups – especially compared to the some 2000 years of existence of “schools” in the broadest sense. Neither the technological nor the pedagogic and didactic concepts applied have converged towards a stable “culture”

As a consequence, we propose to avoid leapfrogging from real to virtual universities. Rather, we suggest a smooth transition that starts with the current and well-understood real universities. Augmenting current teaching venues with new technology leads to digital lecture rooms, digital lecture halls, digital labs, etc. By gradually adapting pedagogic/didactic concepts to the improved possibilities, the evolution process can keep pace with urgently needed feedback and evaluation. Such a “right-paced” smooth transition may include the following intermediate milestones, all of which represent computer-aided teaching set-ups in their own right:

• Computer-augmented frontal teaching is immediately available (same-time / same-place)
• Cooperative Learning can be introduced if learning workplaces get computer-equipped, too
• By hooking the digital venue onto the Internet, both remote humans (e.g., guest expert teachers) and remote “bits” (Web sites, remote software) become available (same-time / different-place)
• By mirroring the digital venue set-up, distributed venues can be created, allowing two or more distributed classes to follow a single lesson
• As streaming and eventually multicast support are added, remote learners may join in
• Taking different kinds of recordings as ‘raw’ material, a first level of different-time / different-place learning can be introduced: this ‘raw’ material can be post-authored into valuable course material for rehearsal and/or self-paced learning; note that i) by exploiting the available variety of digital/intelligent software capturing possibilities, one can reach a whole lot more than the boring “video-taped lessons” of the past; ii) like for all other items in this list, the advantage lies in the smooth gradual and right-paced transition from classical lecturing to computer-aided modes.

• Introducing new pedagogic/didactic strategies, one can further the above milestones towards group- and network-centred asynchronous learning concepts which strengthen learner skills such as autonomous knowledge working, responsible group working, etc.

• Only on the “last miles” of this path, virtual reality comes in. More important than virtual campuses, virtual labs should be considered here: given the high actual cost and short innovation cycles of laboratories in high-tech domains, wide-spread access to costly up-to-date experimental facilities (be it virtual access to real labs or entirely virtual labs) must be considered a crucial element of educational systems in the future, both from a budget perspective and from an equal educational opportunity perspective.

PART II: The Digital Lecture Hall DLH

At a first glance, the first milestone described in part I suggests a digital teaching venue featuring i) digital course material, ii) interactive whiteboards for both handwriting-only and annotation based teaching, iii) audio capturing; and iii) video recording. For all other milestones, networking is the key enabling technology. At second sight, DLH design turned out to be challenging. The major components finally chosen are listed below:

- The basic display system is a seamlessly concatenated set of three LCD beamers, all virtually integrated into a single computer screen (the HW/SW solution is scalable to up to 16 beamers). On top of this single screen, a virtual multi-blackboard system is implemented: screens presented and annotated by the teacher do not vanish as the next screen is opened, but are shifted aside for further view like in traditional lecture halls.
- For teacher input, both an interactive whiteboard (rear-projection Smartboard™) and a LCD tablet are used. Interactive whiteboards naturally extend the traditional whiteboard-based teaching, yet remain limited in size to the reach of hands of the writer; therefore, they must be integrated with the large display system. Whiteboards also have the disadvantage that if learners are to see the writing, it has to be set up such as to force the teacher to turn her or his back to the learners. This disadvantage is avoided with the LCD tablet. A 14” LCD screen, it allows interactive input with a high-precision stylus. The display can synchronously displayed on the large screen; like the interactive whiteboard, it supports easy combination of pre-authored slides, live input (from Web sources, animation software, videoconferences etc.), and on-line annotation / writing. Clearly, the two devices for teacher input are complementary; field evaluation is supposed to prove their mutual (dis-)advantages.
- For hooking-on local learners, the entire classroom is equipped with IEEE802.11 based wireless LAN technology. A connection kit will be offered to students for them to connect personal laptops. The kit includes custom software for interactive participation in the lectures; major goals are i) to reduce the problem of relating student questions to the material presented (teachers permitting, a student can, e.g., display and mark/annotated teacher’s writings related to questions); ii) to capture the questions and interactions both for synchronous broadcast to remote participants and for recordings (FAQ-lists etc.).
While high-speed networking connects the DLH to the Internet, particular attention is paid to providing scalable data streams: for connection to remote lecture halls, the bandwidth can hardly be large enough (in terms of perceived telepresence!), for individuals participating from home, it can hardly be small enough. The project faces this challenge not only on the level of data compression (e.g., video codecs), but particularly on the application level (e.g., prioritising / round-robin switching of media / streams, pre-lecture uploads, etc.).

As to visual interconnection over the net, a particular emphasis is put on multi-perspective video. It is proven that the “peep-hole” effect evoked by single-camera transmission is the most serious obstacle for teleteaching. For remote lecture halls, this applies to both directions! The DLH is therefore equipped with a series of pan-zoom-tilt cameras which can be operated manually, remotely, and automatically (applying, e.g., video-follows-audio tracking).

A substantial number of software tools is added, supporting the different educational setups sketched above. Many of these tools are identified as part of the project and either available on the market or under construction; some additional tools are supposed to turn out helpful as the project progresses.

Finally, a software-based operation-and-management console offers access to basic electric installation. The APIs of suitable HW/SW are currently adapted for seamless integration with the residual DLH software.

While the final presentation at Ed-Media will provide more details excluded here for the sake of space, it can not be a “final report” as the project will continue for years for good reason: i) the milestones described must be accompanied with sufficient feedback from teaching experience, several improvement cycles must be foreseen and are crucial for the success of the follow-on milestones; ii) we are not lacking technology mainly but innovative appropriate pedagogic/didactic concepts; iii) once these concepts come up, dramatic backlogs must be expected with respect to both operational know-how and appropriate software tools (for each milestone!), let alone availability of appropriate actual course material.